

# **CARBON HEATING APPARATUS ~~USING~~ UTILIZING A GRAPHITE FELT AND METHOD OF MANUFACTURING METHOD THEREOF**

## **BACKGROUND OF THE INVENTION**

### **5 1. Field of the Invention**

The present invention relates to a carbon heating apparatus ~~using~~ utilizing a graphite felt and a manufacturing method thereof. ~~More specifically~~ particularly, the invention relates to the carbon heating apparatus using a graphite felt and manufacturing method thereof characterized in that: incomprises a carbon heater used in equipment for heating a room or applying heat, and so on by an electrical heating characteristic made of a carbon fiber, wherein the electrical heating characteristic is produced by sealing the carbon heater, formed by cutting the carbon fiber into forming with a predetermined section and length and heat treated in a hydrogen gas atmosphere under a preset high temperature to make uniform surface cut structure, into a quartz glass tube for enveloping and sealing the carbon heater, and a pair of terminals for securely attaching both ends of the carbon heater to prevent unwanted sparks and loosening the carbon heater. a particle structure on a side face, formed more unevenly over a particle structure on a plane by cutting a plane shape of the mineral carbon fiber into the predetermined section and length, becomes a stable structure by a predetermined process, i.e., a heat treating process; and an arch discharge or a terminal secession produced between the carbon heater and a feeding terminal can be prevented by using superior metals in contraction strength or compression strength, in both ends of the heat treated carbon heater.

### **25 2. Description of the Related Prior Art**

Generally, ~~in the~~ carbon heating apparatus ~~using as a heat source heat produced by~~  
~~the arc discharge and Joule heat and producing~~ a ~~high~~extreme ~~temperatures of heat by~~  
~~the~~due to arc discharge and Joule heating through the contact resistance between carbon  
5 particles, ~~produced~~ in response to an electric current flowing into the both ends of the carbon  
particles received in an insulator, ~~since~~ Since the carbon fiber was invented at an early  
~~age~~many years ago, the carbon heating apparatus ~~has been constituted to for~~ produce  
~~producing heat by applying electricity to the both ends of the carbon heater, wherein the both~~  
~~ends of the carbon heater use~~ employs directly carbon yarns, a plurality number of twisted  
10 carbon yarns ~~spun~~, or a textile type of a graphite felt cut as needed by applying electricity to  
both ends of the carbon heater. Also, although the carbon heating apparatus element is  
~~constituted to form a smooth eye~~enveloped in a glass tube by injecting ~~filled with~~ an inert  
gas, typically using a silica glass or a hard glass, However, the hard glass is not ~~fit~~ suitable  
to be a heater which maintain continuously ~~produces at~~ extremely high temperatures ~~of heat.~~  
15 Accordingly, a carbon heater in portions for continuously producing a high temperatures,  
such every process as in a semiconductor manufacturing apparatus has been used from an  
early age a constitution has a construction that the carbon heater ~~was~~ is sealed into at the  
quartz glass, to prevent it from oxidizing ~~evne~~ in ~~the~~ a high temperature environment.

According to Fig. 1 which is illustrating a front view of the general conventional  
20 carbon heating apparatus ~~of the prior art, it the carbon heating apparatus of Fig.1 has a~~  
structure that the carbon fiber of the carbon heater (2) is sealed into a bar shaped of the quartz  
glass tube (1) and the ends of the quartz glass tube are melted and sealed ~~in the state of for~~  
stably connecting to the terminals of outside power supply lines to both ends of the sealed  
carbon fiber to receive the power supply from the outside. In the illustration above  
25 illustration, the graphite felt cut into a predetermined length and sectional area is used as the

carbon fiber.

As shown in Fig.2, however, the upper face of the carbon fiber such as the graphite felt is smoothly formed as shown in Fig.2, while its rough cut of side surface has a lot of since minute carbon particles are exposed to the outside as shown in Fig.3, its side face has a shape capable of. The exposed particles are easily being seceded separated by effects from the outside light impact. In the case of using the carbon heating apparatus upon for heating or cooking, despite precisely controlling and cutting the sectional area and length to precisely derive a required resistance value and a resulting value of a power consumption power, many users would typically use having the graphite felt cut the graphite felt to by a desired regionsize and shape as needed by, using tools such as a knife or scissors, etc.

At this time, in state that the minute carbon particles or the no-unwoven pieces, having not been seceded yet produced from the body of the graphite felt cut, are exposed to the outside at the cutting surface, if it is immediately sealed into the quartz glass tube without treatment, the exposed carbon particles pieces are joined with themelted inside of the quartz glass tube to produce unwanted arcs and also to suppress interrupt the operating cycle when the particles evaporated into the inside wall of when the quartz glass tube are is heated, Thereby, it will be to have bad effect on negatively impacting the thermal efficiency and durability of a lamp, and a the life of a machine.

On the other hand, the both ends of the carbon fiber processed as above use materials such as molybdenum or nickel to make a terminal, and as a general method, it is processed to have a the shape of a spring.

In this case, there are generated it generates several problems due to contraction strength or compression strength. In the case of connecting the both ends of the carbon fiber using the spring shape of terminal, arc discharge maybe produced between the terminal and the carbon fiber materials is produced discharge to causeing contraction and expansion

~~actions relative to each other, thereby to causing a short there-between or secede separation of the fiber itself from the terminal, and to increaseing contact resistance there-between to have bad affectand having a negative impact on durability.~~

## 5 SUMMARY OF THE INVENTION

The present invention ~~has beenis~~ proposed to solve the problems described above. ~~It is a~~An objective of the present invention is to provide a carbon heater with smooth surfaces shape of a carbon heater and a manufacturing method thereof, not having minute carbon particles or ~~no unwoven pieces capable of remaining in~~remained on the outside of a graphite felt cut into a predetermined preset length and width, ~~upon making the carbon heater using a carbon fiber such as the graphite felt.~~

~~It is~~Another objective of the present invention is to prevent a unwanted local arcs from occurring to allow and smooth operating cycle to smoothly progress when the carbon heater is heated, thereby to enhance thermal efficiency and durability of the carbon heater, ~~wherein the local arc can be produced by the minute carbon particles or the no woven pieces remaining in the quartz glass tube into which the carbon heater is sealed,~~

~~It is~~Still another objective of the present invention is to improve a the structure of a terminal fixing fixtures for securely attaching both ends of the carbon heater to prevent ~~them~~ from ~~being seceded separation from it~~ due to contraction and expansion actions relative to each other, ~~thereby to previously prevent are from occurring.~~

The other ~~objects~~features of the present invention will be described ~~more~~ fully in conjunction with ~~constitutions~~constructions and actions described below.

## 25 BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a front view showing a conventional ~~typical~~ carbon heating lamp.

Fig. 2 is a plane view showing a plane state after cutting a carbon fiber used in the conventional carbon heating lamp.

5 Fig. 3 is a side view showing a side surface state after cutting the carbon fiber used in the conventional carbon heating lamp.

Fig. 4 is a front view showing a carbon heating apparatus according to the present invention.

10 Fig. 5 is a partially enlarged perspective view showing a plane state and side surface state of the preferred carbon heater according to the present invention.

Fig. 6a is a plane view showing the first embodiment of terminal ~~portions~~ parts according to the present invention.

Fig. 6b is a side view showing the first embodiment of the terminal ~~portions~~ parts according to the present invention.

15 Fig. 6c is a front view showing the first embodiment of the terminal ~~parts~~ portions according to the present invention.

Fig. 7a is a partially enlarged plane view showing the first embodiment of the terminal ~~parts~~ portions according to the present invention.

20 Fig. 7b is a partially enlarged front view showing the first embodiment of the terminal ~~parts~~ portions according to the present invention.

Fig. 8a is a plane view showing the second embodiment of the terminal ~~parts~~ portions according to the present invention.

Fig. 8b is a side view showing the second embodiment of the terminal ~~parts~~ portions according to the present invention.

25 Fig. 8c is a front view showing the second embodiment of terminal ~~parts~~ portions

according to the present invention.

Fig. 9a is a partially enlarged plane view showing the second embodiment of the terminal partsportions according to the present invention.

Fig. 9b is a partially enlarged side view showing the second embodiment of the  
5 terminal partsportions according to the present invention.

Fig. 10a is a plane view showing the third embodiment of the terminal partsportions according to the present invention.

Fig. 10b is a side view showing the third embodiment of the terminal partsportions according to the present invention.

10 Fig. 10c is a front view showing the third embodiment of the terminal partsportions according to the present invention.

Fig. 11a is a partially enlarged plane view showing the third embodiment of the terminal partsportions according to the present invention.

Fig. 11b is a partially enlarged side view showing the third embodiment of the  
15 terminal partsportions according to the present invention.

Fig. 12 is a flow chart showing a preferred ~~manufacturing method of~~ manufacturing the carbon heating ~~apparatus device~~ according to the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

20

The carbon heating apparatus of the present invention ~~to solve the problems as described above characterizing by comprising~~ comprises: a carbon heater (20) ~~processed by~~ made of ~~cutting a predetermined carbon fiber cut in~~ having a constant form ~~to have~~ with a predetermined length and width and performing a heat treatment ~~against for~~ the side surface  
25 cut in a hydrogen gas atmosphere ~~of~~ under a predetermined high temperature to obtain

uniform surface cut structure; a pair of terminal portions-parts (30) connected with to the  
outside power supply lines (40) of a predetermined material to provide an electrical  
connecting path to both ends of the carbon heater, the terminal parts having a flat portion (31)  
at one end for connecting to outside power supply lines by welding means and a pair of  
5 clamping brackets (32) with protrusions (33) at opposite end for securely attaching to the  
carbon heater; and a quartz glass tube (10) having melting-joined-jointing portion (15)in-state  
that the carbon heater isfor sealeding and the terminal portions are located at the both ends of  
the carbon heater (20).

Preferably, ~~in the carbon heater sealed into the quartz glass tube is inserted~~includes a  
10 ribbon of molybdenum having of a predetermined thickness and width to prevent oxidation of  
the carbon by in case air penetrated-leaks into the quartz glass tube upon producing a leak  
therein,; thereby to protect functions of the heater, wherein theThe ribbon of molybdenum  
preferably has preferably a thickness of 28μm to 30μm and a width of 3mm to 4mm.

Also, the carbon heater can be formed preferably in a bar shape having a tetragonal  
15 cross section, wherein-section that one end of the terminal portions-parts (30) is formed in a  
circle of a -circular thin metal thin film-for surrounding-circumferentially attaching the  
carbon heater, while the other end of the terminal portions-parts is extended from the eircle-of  
thecircular thin metal thin film-and-for weldeding with the outside power supply lines.

~~Further, S~~Since the carbon heater uses mineral carbon materials such as coke or coal;  
20 and so on to be capable of outputting about 800 watts-of a high-output, it can be constituted  
constructed to bear up-against-a withstand high temperatures-of heat.-

Also, the method of manufacturing the carbon heating apparatusdevice manufacturing  
method~~according to the present invention characterizing by including~~comprises the steps of:  
forming a carbon heater by cutting a predetermined carbon fiber in a constant form to have a  
25 predetermined length and width; heat-treating the cut-carbon heater cut in a hydrogen gas

atmosphere of a predetermined temperature under a high vacuum to ~~make~~ obtain its surface uniform cutting surface; after ~~putting~~ inserting the carbon heater ~~heat-treated~~ into a quartz glass tube and injecting the hydrogen gas, baking it at a predetermined temperature to remove impurities; primary aging the baked carbon heater ~~baked~~ by applying a primary aging voltage ~~to it~~; secondary aging the carbon heater by applying a secondary aging voltage ~~to it~~; and after confirming the vacuum state, sealing the quartz glass tube.

Preferably, the process for cutting the carbon fiber may includes a press cutting, ~~or a~~ laser cutting ~~methods~~, and so on to ~~cleanly form its~~ cut the side face ~~cut as much~~ clearly as possible.

Also, the heat-treating ~~step process~~ is made-performed for about 2 to 3 minutes in the hydrogen gas of  $900^{\circ}\text{C}$  to  $1000^{\circ}\text{C}$  under a high vacuum of at least  $10^{-5}$  Torr, the baking ~~step process~~ is made-performed at the temperature of  $1600^{\circ}\text{C}$  to  $1700^{\circ}\text{C}$  to remove impurities, ~~and the~~ primary aging voltage ~~of is~~ 60V to 70V and the secondary aging voltage ~~of a rated voltage is~~ 100V ~~may be applied~~.

The preferred embodiments of the present invention will be described ~~below more~~ fully with reference to the accompanying drawings.

In the following description of the preferred embodiments ~~of the invention~~, detailed descriptions ~~of the~~ well-known functions or constitutions are omitted so as not to obscure the subject matters of the present invention with unnecessary detail. The terms described below are established taking into account the functions of the present invention. ~~However, s~~ Since the terms may be changed in accordance with manufacturer's intention or practice, the meanings of the terms should be defined based on the whole contents of the specification.

Fig. 4 is a front view showing a carbon heating apparatus according to the present invention, and Fig. 5 is a partially enlarged photograph showing ~~a the side surface state of a~~ preferred carbon heater according to the present invention.



Referring to Fig. 4, a quartz glass tube (10) uses ~~any one of either~~ a quartz glass made by melting crystal, a quartz glass made from a high purity of  $\text{SiCl}_4$ ,  $\text{SiH}_4$ , and so on as a starting ingredient, a quartz glass made by melting silica, ~~and or~~ a quartz glass made from silica glass as an ingredient.

In the case of using ~~the~~ quartz glass made from ~~the~~ silica glass as an ingredient, it is typical to make a film layer of the quartz glass; by a method including the steps of: molding the silica glass at about  $550^\circ\text{C}$  to  $620^\circ\text{C}$ ; dividing— into  $\text{B}_2\text{O}_3$ - $\text{Na}_2\text{O}$  phase and  $\text{SiO}_2$  phase; ~~making—performing~~ an acid treatment with hydrochloric acid ~~etc or the like~~; and ~~making~~ performing a heating treatment process at about  $1000^\circ\text{C}$  to  $1200^\circ\text{C}$ , ~~and~~ Other methods are also available.—

Also, the quartz glass tube (10) of the present invention uses the purity 99.5% of  $\text{SiO}_2$  and a working point of  $1700^\circ\text{C}$ , as represented in Table 1.

Table 1

No	Ingredient	Coefficient of Thermal Expansion	Specific gravity	Stress point $^\circ\text{C}$	Annealing point $^\circ\text{C}$	Softening point $^\circ\text{C}$	Working Point $^\circ\text{C}$
1	99.5% of $\text{SiO}_2$	5.5	2.2	956	1084	1580	1700
2	Corning 1742	45		745	820	1015	1300
3	GE 180	44	2.64	674	726	928	1200

Also, the quartz glass tube (10) typically has a thickness of about  $0.04\text{mm}$  to  $3\text{mm}$  on average to obtain ~~an enough~~ sufficient mechanical strength.

The most characteristic portion of the present invention is the carbon heater (20) sealed into the quartz glass tube (10), wherein the carbon heater (20) is ~~constituted~~ formed by cutting the graphite felt known as a carbon fiber into a desired length and a predetermined width ~~fitted as required by the desired~~ with resistance value.

The graphite felt used in the present invention is manufactured using mineral carbon

materials such as coke or coal, etc. ~~Since it is possible for the use of the mineral carbon materials to output a high watt of a high output beyond a heating range capable of being emitted from far more heat than~~ vegetable carbon materials, it is advantageous that the graphite felt can ~~bear up against a withstand~~ high temperatures ~~of heat~~ and can be designed to  
5 be ~~coincided compatible~~ with any rated voltages in the range of 100-V to 220V.

~~And, the~~ The method for cutting the graphite felt may includes a press cutting method ~~using a press cutting~~, a dedicated jig, or a wire cutting method that, to the extent possible, does not produce carbon particles or ~~no unwoven pieces on the cut side surface cut as much as possible.~~

10 The amount that the carbon particles or ~~the no unwoven pieces~~ are exposed to the outside is sharply reduced in the side surface of the carbon heater (20) that is cut by ~~the press cutting~~, the dedicated jig, or ~~the wire cutting~~, in comparison with the method using scissors or a knife of the prior art. ~~However, comparing that~~ comparing to the smoothly formed upper surface of the carbon heater (20) is smoothly formed, the section structure of the side surface  
15 ~~of which the section structure is relatively rough is formed. As the result~~ For this reason, the side surface cut is heat-treated for about 2 to 3 minutes in a hydrogen atmosphere of 900°C to 1000°C to change its physical properties, thereby to form ~~the a side surface similar to the~~ that is just as smooth as the surface of the upper surface.

The carbon heater (20) is heat-treated before it is sealed into the quartz glass tube  
20 (10), thereby making its side surface smooth ~~simultaneously with~~ as well as removing impurities remaining in its side surface. ~~As thea result, nothing remains~~ no impurities are present, upon inserting the heat-treated carbon heater (20) ~~heat-treated~~ into the quartz glass tube (10).

A terminal ~~portion part~~ (30) is constituted to connect the carbon heater (20) to the  
25 outside power supply line (40) for providing an electrical path and a mechanical connection.

4

The terminal ~~part~~portion (30) is—preferably consisted of metal materials such as molybdenum or nickel, wherein it may take various embodiments according to the invention as shown in Fig. 6A to Fig. 10. In Fig. 4, the terminal partportion (30) ~~takes are in~~ the form of the first embodiment illustrated more fully in Fig. 6A to Fig. 7B.

5 According to Fig. 6A to Fig. 6C, one end is ~~constituted into~~of a terminal ~~portion~~parts forms a flat plate (31) for ~~connecting to a power supply, welded to the outside power supply~~ line (40), while other ~~the end is constituted into~~of a terminal ~~portion~~parts forms a pair of clamping brackets (32) for ~~circumferentially wrapping the carbon heater,; wherein~~ Thus, the ends of the carbon heater (20) ~~may be arrived safely and are securely fixed at and to the~~ inside of the ~~clamping brackets terminal portion~~(32).

The ~~clamping brackets terminal portion~~(32) for the carbon heater ~~is~~are further provided ~~mounted with a pair of supporting protrusions (33) that can firmly clasp the carbon heater (20) arrived safely to secure it at the inside and to prevent it from seeding separation easily.~~

15 Fig. 7A and Fig. 7B are partially enlarged views showing the terminal ~~portion~~parts (30) according to the first embodiment. This configuration of the attachment bBetween the terminal ~~portion~~parts (30) ~~constituted as above and the carbon heater (20) is~~will not caused discharge ~~unwanted arcs or sparks.~~

20 Accordingly, ~~events, incidents~~ such as a short ~~caused~~ by contraction and expansion ~~actions relative~~ to each other or the ~~secession separation~~ of the carbon fiber itself from the terminal ~~parts~~; are not ~~caused occurred, and~~ Tthe contact surface is much wider than that of a conventional spring form ~~terminals for~~to reduceing contact resistance and ~~to enhanceing~~ durability.

25 As shown in Fig. 8 to Fig. 11B, another type of the terminal parts are presented according to ~~show~~ the second and ~~the~~ third embodiments of the terminal ~~according to the~~

present invention, ~~and~~ Fig. 8A to Fig. 9B show a connection member (50) between the terminal parts (30) and the outside power supply line (40). As shown in Fig. 10A-10a to Fig. 11B-11b, show the constitution another configuration that of the terminal portion 32 parts for surrounding the carbon heater is formed forms at least two circular thin metal parts (34) with bent up and down shape parts(35) so that ~~the spring~~ a pair of clamping bands (36) can be ~~fixed installed into its at both end sides to prevent the carbon heater it from coming loosening off.~~

~~Also, although not shown, making~~ Although the conventional spring terminals (3) of adopts about 5mm, into at the spring terminal for the clamping bands (36) of the present  
10 invention of adopts 8mm to 10mm can that is significantly enhanced the durability.

~~On the one hand, Fig. 12 is a flow chart showing a preferred manufacturing method of manufacturing the carbon heating apparatus device according to the present invention.~~

The method according to ~~the~~ Fig. 12 includes the steps of: forming the carbon heater by cutting the carbon fiber such as ~~the~~ a graphite felt into a constant form to have a  
15 predetermined length and width (step S1), wherein the length and width of the carbon heater is defined considering a desired resistance value, ~~and~~ density and the cutting method uses the press cutting or the laser cutting, etc.;

heat-treating the carbon heater cut in the step S1 for about 2 to 3 minutes in ~~the~~ a hydrogen gas atmosphere of 900℃ to 1000℃ under a high vacuum of at least  $10^{-5}$  Torr to ~~make~~  
20. obtain its surface uniform cutting surface (step S2);

after ~~putting~~ inserting the heat-treated carbon heater into a quartz glass and injecting the hydrogen gas, baking it at predetermined temperature of 1600℃ to 1700℃ to remove impurities (step S3);

primary aging the baked carbon heater ~~baked~~ in the step S3 by applying a primary aging  
25 voltage ~~to it~~ (step S4);

secondary aging the carbon heater that has undergone the primary aging by applying a secondary aging voltage to it (step S5); and

sealing the inside of the quartz glass tube into which the carbon heater is sealed, after confirming a vacuum state, once the secondary aging is completed in the step S5 (step S6),

wherein ~~When the quartz glass tube is sealed by~~ upon melting and molding the quartz glass tube, it ~~would typically use a~~ LPG O<sub>2</sub> burner ~~would typically be used~~, but the present invention uses a high temperature hydrogen burner of ~~a high temperature of~~ 1500°C to 1700°C ~~as much as possible to mold it in as short a time as possible with~~ while minimizing the effect on the carbon materials.

Assuming that the carbon heating apparatus is manufactured according to the present method, the cut side surface of the carbon heater ~~cut~~ is heat-treated in step S2 to make its surface properties uniform and at the same time to remove impurities, the carbon heater becomes stable through the aging processes of steps S4 and S5, and the quartz glass tube is ~~melting-sealed~~ fused in the shortest possible time using the hydrogen burner of a high temperature in step S6 to prevent stress from being exerted on the carbon materials.

Also, the other heat-treating method according to the present invention includes the steps of: heat-treating the cut carbon heater for about 2 hours under a high temperature of 300°C in a process corresponding to ~~the~~ step S2, and then slowly cooling it for 1 hour to make the section structure of the side surface thereof stable; and ~~putting~~ inserting it into the quartz glass tube and performing the baking and aging processes through ~~the~~ steps S3, S4 and S5.

After the vacuum process for the quartz glass tube is completed, dibromoethane of the mixed gas of methylene 0.25% and bromide 70% is injected ~~and sealed into it~~ the tube and then ~~its~~ both inlets are sealed. After this, the carbon heater in which has undergone the aging ~~has been undergone~~ is heat-treated for about 2 hours under a high temperature of 300°C

Although the preferred embodiments of the present invention have been disclosed as describe above, those skilled in the art will appreciate that various modifications and changes are possible, without departing from the scope and spirit of the invention. The technical protective range will be defined by the accompanying claims

5           The invention can provide a ~~smooth shape of a carbon heater~~ with smooth surfaces not having minute carbon particles or ~~no unwoven pieces~~ capable of remaining in the outside of a graphite felt that has been cut into a predetermined length and width, upon making the width to make a carbon heater using the carbon fiber such as the graphite felt; and Thus it will prevent a local unwanted arcs and from occurring to allowing smooth operating cycle to  
10 ~~smoothly progress~~ when the carbon heater is heated, thereby ~~to enhance~~ the thermal efficiency and durability of the carbon heater, wherein the local arc can be produced by the minute carbon particles or the no woven pieces remaining in the quartz glass tube into which the carbon heater is sealed, Comparing with the conventional carbon heater, the present carbon heater does not occur unwanted the arcs due to the heat-treatment to remove the  
15 minute carbon particles or theno unwoven pieces remaining at the cutting surface.

Also, the invention improves ~~a the~~ the structure of a terminal ~~fixing fixture~~ to securely bond both ends of the carbon heater ~~of which the side face is improved through a heat treatment according to the invention to prevent them from being seceded from its separation due to the contraction and expansion actions relative to each other, thereby to previously preventing arcing between the terminal and the heater from occurring.~~

20 preventing arcing between the terminal and the heater ~~from occurring.~~

Further, the present invention can manufacture a carbon lamp which can output ~~consumption power of at least 800 W~~ of power and which can be used even in voltage of at least 220V, wherein the lamp is widely applied to various industrial products such as a ~~roast fish~~ roasting utensil/appliance, a kitchen appliance/utensil, an electric stove, a duplicator, an  
25 electric heat remedy appliance/utensil, etc.

## ABSTRACT

\_\_\_\_\_A carbon heating apparatus using—utilizing a graphite felt and a method of manufacturing method thereof is—  
are presented comprising—of: in a carbon heater used in  
5 equipment for heating a room or applying heat, and so on by an electrical heating  
characteristic—made of a carbon fiber cut having a preset length and width, being performed  
heat treatment in a hydrogen gas atmosphere,—wherein the electrical heating characteristic is  
produced by sealing the carbon heater, formed by cutting the carbon fiber such as the graphite  
felt into a predetermined section and length, into a quartz glass tube, a particle structure on a  
10 side face, formed more unevenly over a particle structure on a plane by cutting a plane shape  
of the mineral carbon fiber into the predetermined section and length, becomes a stable  
structure by a predetermined process, i.e., a heat treating process; and an arch discharge or—a  
terminal secession produced between the carbon heater and a feeding terminal can be  
prevented by using superior metals in contraction strength or compression strength, in both  
15 ends of the heat treated carbon heater. a pair of terminal parts having a flat portion (31) at one  
end for connecting to outside power supply lines and clamping brackets (32) with protrusions  
(33) at opposite end for securely attaching to the carbon heater, and a quartz glass tube (10)  
with melt-jointing portions (15) for sealing both ends of the carbon heater. The  
manufacturing method comprises the steps: forming a carbon heater by cutting carbon fiber  
20 in a preset size, heat-treating in a hydrogen gas under a high temperature and vacuum to have  
uniform cutting surface, inserting the heat-treated carbon heater into a quartz glass tube and  
injecting the hydrogen gas, baking at a high temperature to remove impurities, primary aging  
and secondary aging the carbon heater and sealing both ends of the quartz glass tube.